Study of Morphometric Characteristics of Upper Kundalika River Basin, Dist.Raigad, Maharashtra.

By

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Introduction: -

Morphometry is the precise & objective measurement of landform morphology and it involves quantitative analysis of geometric properties of the feature. Strahler A.N.(1957) describes the term morphometry as measurement of the shape or geometry of any natural form. Clarke J. I. (1970) defines morphometry as the measurement and mathematical analysis of the configuration of the earth's surface, shape and dimensions of the land forces.

Morphometry is divided into two branches 1) Relief Morphometry 2) Fluvial Morphometry. Relief Morphometry includes an analysis of the relief of the terrain with the help of absolute relief relative relief, slope aspect etc. While fluvial morphometry includes the consideration of linear, areal and relief aspect of fluvial originated drainage basin. In linear aspect analysis related to streams such as stream order hierarchy, stream numbers, stream length etc. is done. Areal analysis includes the study of the basin parameter shape of the basin.

The importance of the catchment scale is to observe how physical habitat diversity and interacts on a large scale with river flow processes. The catchment scale is also used to determine where groundwater enters into the river system by means of hypsometric exchange (Baxter and Hauer 2000). Other physical features described at the catchment scale include the general geologic setting, the orientation and aspect of the vegetation types and the hydrologic flow regime. These features dictate the basic valley types that we observe within the catchment, which in turn greatly affect habitat availability and suitability

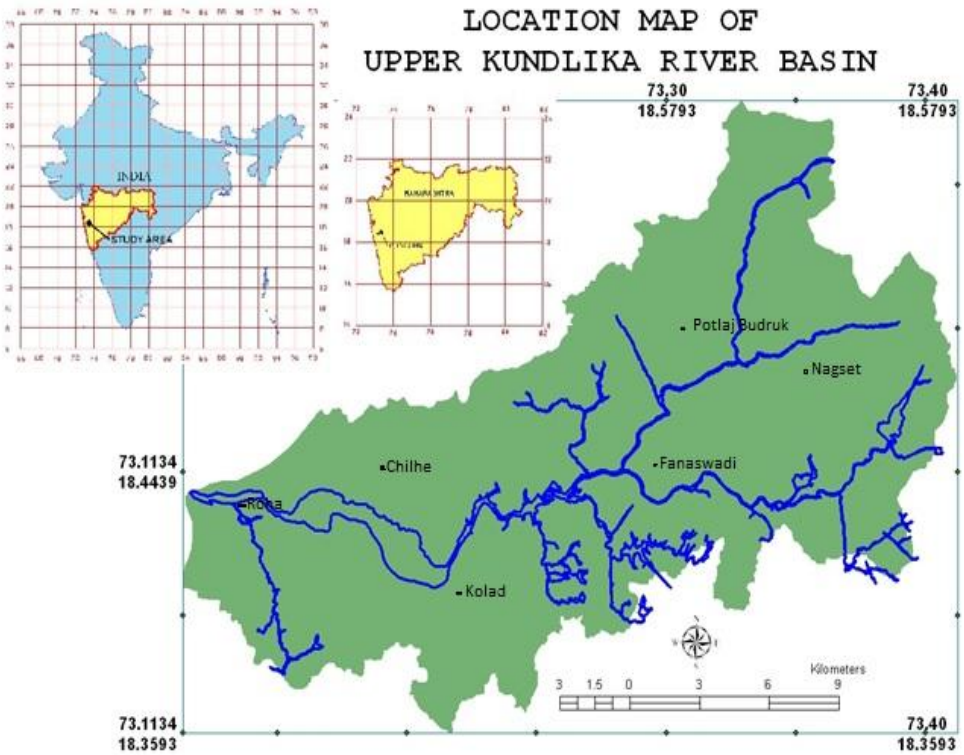
The next smaller geomorphic scale of interest is called the fluvial audit. The fluvial audit provides information about how the river responds to its sediment supply, or the amount of sediment delivered into the river. The sediment budget, or amount of sediment moved through the stream over time, affects the physical properties of the river and aquatic habitat available in the river. Information at the fluvial audit would be used to explain the presence of bars, riffles, and meander bends, and how they relate to the surrounding landscape. This geomorphic scale is important for numerous species of fish, because they can only spawn in certain types of gravel and flow. The processes that operate at the fluvial audit scale generate the greatest stream habitat diversity by distributing different size gravels throughout the stream system. The variety in distribution of gravels is partially responsible for creating the dynamic features in a river that the

fish are dependent on for survival. Specifically, these features are also responsible for creating micro flow conditions, such as riffles with inter gravel flow, which many species of fish rely on for reproductive success.

These units are further assessed for suitability of wet land agriculture, tree crisp, irrigation, settlement, interest and conservation.

About the Study Area:

The latitudinal extent of the study sector is 18°27"to 18°29" North and longitudinal extent is 72°43" to 73º10" East. The Kundalika maintains fairly straight course in E - W direction up to Roha and then follows as SE-NW trend. The **Kundalika** is a small river flowing from the Hills of Sahyadri to the Arabian Sea. This river originates at a small town called Bhira in the Indian State of Maharashtra, 150 km south east of Bombay (Mumbai). The important towns located on the banks of Kundalika are Kolad, Korlai, Chaul, Roha and Salav**.** The river channels in this area are very shallow and even in case of main rivers the relief along the blanks is of 3-4 m. The tributary stream also has very shallow channel. The soil covers in most of these areas is poor and rocky exposures are quite commonly observed.



Review of Literature: -

The Morphological system a resultant of geology, climate, vegetation, hydrology, and soil provide a base for land classification. It has a decisive role as far as differentiation and landscape systems properties are concerned (Majur, 1981). In the western countries the contributions of Slovak Academy of sciences (Majur, 1981) and an environmental analysis group of Spain (1980) are noteworthy in this direction. Morphologically the area is an interesting one having a strong structural control on the drainage pattern (Nair et al 1975)

Much of the past geomorphological effort in India has concentrated on drainage and basin morphology (Singh 1983, Vaidyanadhan 1983) and on the fluvitite deposits within major valleys. The shape, size and area of the channels are closely related to the discharge (Schumm,1977) early investigators have demonstrated that width of channel is significantly related to channel cross-section and to discharge (Leopold and Wolman 1970, Schumm,1977). An ineffective and incompetent river, which is unable to efficiently transport the sediments (Schumm and khan,1972, Knighton,1972) A wide and shallow channel increases turbulence as well as the critical tractive force (up to a certain level) Schumm (1977). Slope analysis is an important aspect of geomorphic studies, in the present analysis, the Smiths (1953) grid pattern method has been employed and isopleths are drawn on the basin to indicate areas having same local relief.

Strahler (1952 & 1957) demonstrated the advantages of hypsometric analysis and has drawn type curves for different stages of erosion.

There is plethora of literature available on watershed management programme covering wide range of issues. However, in this piece of work we have only attempted to review selected literature from the vast sources literature available in the context of understanding major issues, impact and effectiveness of the programme. Studies by Farrington, et al (1999), Deshpande and Narayanamoorthy (1999), Kerr et al (2000), Vaidyanathan (1999, 2006), Reddy and Dev (2006), Biswas, et al (2005), Pascual, et al (2009) and others have discussed several issues in watershed development programmes. They have covered policy related issues, institutional drawbacks, implementation issues, community and participation issues, etc. Despite the fact that there are large numbers of issues already covered, the research scope in the issue of

watershed management is tremendous. Over the years, with the attention shifted from more centralized to decentralized system of governance, watershed development programmes have equally emphasized on decentralized approaches such as more community and peoples participation and involvement of PRIs in planning, executing and monitoring of the projects, etc. To ensure good governance, mechanisms like social auditing, periodic review and better documentation processes are taken into account as best practices in some of the WDP regions. There is a good number of studies available on participatory aspects of watershed management. Wani, et al (2001) study in Kothapally in Andhra Pradesh is one 6 of such studies that highlight the effective community participation in watershed management. In fact, their study has developed the model for effective participation in watershed management. Deshpande and Reddy (1991), Shah (2001), Joshi (2004) and others have reviewed different dimensions of watershed management. These studies while addressing several issues have also focused the positive impact of watershed management on cropping, agricultural productivity, employment generation and increase in income amongst others. The Kothapally study by Wani et al (2001) has shown significant impact of watershed management on crop production, increase in ground water level, reduction in runoff water, increase in income etc. Similarly, ICRISAT has reported various benefits of the watershed development programmes in the country.

Objectives of the study: -

1) To study the drainage network characteristics of Kundalika basin.
2) To do the drainage morphometry of the basins and sub-basins of Kundalika river.
3) To study the channel bed sediment in Kundalika and its tributaries.
4) To study the water quality of Kundalika river.
5) To identify various Land uses in the basin area.
6) To study the changes in land cover changes in the area.

Design of the thesis:

The work shall be presenting in eight chapters including introduction. The first chapter is devoting to the general information on river basin morphometry along with related survey of literature. Study area and the method of research employed are discussed at length in chapter

two. Chapter three is devoting to preparation of drainage basin map of Upper Kundalika river with the help of Google satellite image and 10.2.2 Arc GIS Software. The fourth chapter discusses slope analyses of that Upper Kundalika watershed area with calculating slope angles of absolute relief map, relative relief map, dissection index map, and slope map respectively. In the chapter five searching that stream pattern of the Upper Kundalika River. In the chapter six all hydrological characteristics are shown with the help of map and profiles. In the seventh chapter relate to land use pattern of the study area. The observations, findings, conclusions and suggestions are providing in the final chapter of the thesis.

Methodology:-

The following techniques shall be used in Morphometric analysis.

Techniques and Tools used:

GIS based image processing and mapping were used ASTER data for preparing digital elevation model (DEM), and geographical information system (GIS) was used in evaluation of linear, areal and relief aspects of morphometric parameters. Watershed boundary, flow accumulation, flow direction, flow length, stream ordering has been prepared using Arc Hydro Tool; and contour, slope-aspect, hill shade has been prepared using Surface Tool in ArcGIS-10.2.2 software, and ASTER (DEM). Different thematic maps i.e. drainage density, slope, relief, superimposed profile, and longitudinal profiles have been prepared by using ArcGIS software.

Methods of Research:

Maps / Laboratory Work/ Wikimapia Images (2010-2013)/ Toposheet no 47F/3, 47F/6, 47F/7 (1927, 1967)	**Field work**	**Techniques and tools used**
A	A	A
1. Preparation of Base Maps 2. Preparation of Geomorphic Map 3. Preparation of Land use and Land cover maps. 4. Preparation of isoline Maps using surfer (interval) software. 5.Cross section profile analysis	1. Collection of sediment samples. 2. Measurement of water Velocity. 3. Collection of soil samples. 4.Collection of water samples	a. Relief Morphometry b. Fluvial Morphometry 1) Linear aspect. 2) Areal aspect. 3) Relief aspect
B		B
1. Calculation of size/shape/of the river. 2. Calculation of correlation and regression. 3. Sieving for grain Size distribution.		1. GIS 2. ASTER (DEM) 3. ArcGIS-10.2.2 4. SURFER 9

Work plan:

First Year:-

A) Reference work in different libraries, literature survey and collection of data.

B) Preparation of base map, drainage network.

C) Procurement of satellite image.

D) Preliminary survey of the study area and pilot sampling.

Second Year:-

A) Reference continued. Surveying and data collection. Sample collection and analysis.

B) Calculation of indices, seasonal mapping and monitoring of the channel.

C) Image analysis and ground truthing.

Third Year:-

A) Completion of data analysis and field checking.

B) Publication of research papers.

C) Thesis writing.

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